[CLAIMS]

What is claimed is:

1. A lighting unit comprising:

a light source unit having an emitter which has a transparent body with a refractive index n0 containing a light-emitting substance sealed in the empty region inside thereof, a housing that houses the emitter and has a reflector formed on an inner surface, and a transparent filler with a refractive index n1 filled in the housing; and

an optical waveguide made of a transparent substance with a refractive index n2 and having a light-emitting surface;

wherein the profile of the light-reflecting surface of the reflector is so modified that the light having been emitted by the emitter and reflected by the reflector to run toward the light-emitting surface of the optical waveguide can reach the light-emitting surface at an incident angle not smaller than the critical angle to the light-emitting surface.

2. The lighting unit as claimed in claim 1, wherein the profile of the light-reflecting surface of the reflector satisfies the requirement of:

$|\theta 1 - \theta 2| < \cos^{-1}(1/n2)$,

in which θ1 indicates the angle between the normal line nA at a point A on the surface and the tangential line l that tangentially connects the point A and the outline of the empty region, and

θ2 indicates the angle between the line segment m that is parallel to the light-emitting surface and is in the plane formed by the normal line nA and the tangential line l, and

the normal line nA.

3. A lighting unit comprising:

a light source unit having an emitter which has a transparent body with a refractive index n0 containing a light-emitting substance sealed in the empty region inside thereof, a housing that houses the emitter and has a reflector formed on an inner surface, a transparent filler with a refractive index n1 filled in the housing, and an optical path-changing device disposed in the transparent filler for changing an optical path; and

an optical waveguide made of a transparent substance with a refractive index n2 and having a light-emitting surface.

4. A lighting unit comprising:

a light source unit having an emitter which has a transparent body with a refractive index n0 containing a light-emitting substance sealed in the empty region inside thereof, a housing that houses the emitter and has a reflector formed on its inner surface, and a transparent filler with a refractive index n1 filled in the housing;

an optical waveguide made of a transparent substance with a refractive index n2 and having a light-emitting surface; and

a reflector formed on the light-emitting surface and having a plurality of open ends.

5. The lighting unit as claimed in claim 4, further comprising the light source units provided at the both ends of the optical waveguide;

wherein a distance, w, between the two light source units

that corresponds to the length of the optical waveguide sandwiched between the two units and a thickness, d, of the optical waveguide satisfy the requirement of $20 \times d < w < 45 \times d$.

6. The lighting unit as claimed in claim 1, wherein the emitter is a discharge tube; and

the dielectric loss tangent of the transparent filler is minimized at around the driving frequency of the discharge tube.

7. The lighting unit as claimed in claim 1, wherein the emitter is a discharge tube; and

the dielectric constant of the transparent filler has a maximum value at around the driving frequency of the discharge tube.

8. The lighting unit as claimed in claim 1, wherein the refractive index n1 of the transparent filler falls between the refractive index n0 of the transparent body that forms the emitter and the refractive index n2 of the optical waveguide.

9. A lighting unit comprising:

a light-reflecting reflector;

a plurality of cold-cathode tubes disposed inside the reflector; and

an optical waveguide connected with the open end of the reflector to guide the light emitted by the cold-cathode tubes;

wherein the reflector has a reflective surface that reflects the light having been emitted by the cold-cathode tubes

in the direction nearly perpendicular to the wall of each tube, in the direction in which the light thus reflected does not re-enter the cold-cathode tubes.

10. The lighting unit as claimed in claim 9, wherein the reflective surface is so disposed that the surface reflects the emitted light at an angle at which the reflected light runs through the space between the cold-cathode tube and the reflector adjacent thereto or between the neighboring cold-cathode tubes.

11. The lighting unit as claimed in claim 9, wherein the reflective surface is so disposed that the surface reflects the light emitted by one cold-cathode tube at an angle at which the reflected light runs through the space between the one cold-cathode tube and the other cold-cathode tube and that the surface reflects the light emitted by the other cold-cathode tube at an angle at which the reflected light runs through the space between the one cold-cathode tube and the wall surface of the reflector.

12. The lighting unit as claimed in claim 9, wherein the reflective surface is composed of a plurality of curved segments.

13. A lighting unit comprising:

a light-reflecting reflector;

a cold-cathode tube disposed inside the reflector;

a first optical waveguide connected with the open end of the reflector for guiding the light emitted by the cold-cathode tube; and

a second optical waveguide disposed in the space between the cold-cathode tube and the reflector and having an end that faces the end of the first optical waveguide.

14. The lighting unit as claimed in claim 13, wherein the profile of the surface of the second optical waveguide that faces the outer surface of the cold-cathode tube is analogous to the profile of the outer surface of the cold-cathode tube.

15. A lighting unit comprising:

a light source unit having a cold-cathode tube with a phosphor dispersed inside the tube, a housing that houses the cold-cathode tube and has a reflector formed on an inner surface, and a transparent filler filled in the housing; and

an optical waveguide guiding the light from the light source unit and emitting the light through a light-emitting surface.

16. A lighting unit comprising:

a light source unit having a cold-cathode tube, a housing that houses the cold-cathode tube and has a reflector formed on an inner surface, and a transparent filler filled in the housing;

an optical waveguide guiding the light from the light source unit and emitting the light through a light-emitting surface;

a temperature sensor for controlling the temperature of the cold-cathode tube; and

a heating element for heating the cold-cathode tube.

17. A lighting unit comprising:

a light source unit having a cold-cathode tube, a housing that houses the cold-cathode tube and has a reflector formed on an inner surface, and a transparent filler filled in the housing;

an optical waveguide guiding the light from the light source unit and emitting the light through a light-emitting surface;

a temperature sensor for controlling the temperature of the cold-cathode tube; and

a heat radiation fin for cooling the cold-cathode tube.

18. A lighting unit comprising:

a light source unit having a light-transmitting transparent body, and a cold-cathode tube formed in the transparent body; and

an optical waveguide guiding the light from the light source unit and emitting the light through a light-emitting surface.

19. A lighting unit comprising:

an optical waveguide guiding light and emitting the light through a light-emitting surface; and

a cold-cathode tube formed inside the optical waveguide.

20. A lighting unit comprising:

a transparent member having fluorescence centers acting to absorb UV rays and emit visible light, and forming at least a part of a wall that surrounds a predetermined empty region;

a UV-emitting substance disposed in the empty region;

and

an electrode disposed in the empty region.

21. The lighting unit as claimed in claim 20, wherein the fluorescence centers for visible light are formed of a mixture of a substance that emits blue-zone visible light and a substance that absorbs blue-zone visible light and emits visible light having a longer wavelength than that of the blue-zone visible light.

22. The lighting unit as claimed in claim 20, wherein the transparent member is composed of a plurality of layers, and at least two layers of the member each contain at least one type of fluorescence centers.

23. The lighting unit as claimed in claim 20, wherein the fluorescence centers are a combination of fluorescence centers to emit R (red) zone light, fluorescence centers to emit G (green) zone light, and fluorescence centers to emit B (blue) zone light, and when the quantum yields of these three types of fluorescence centers are designated by $\sigma(R)$, $\sigma(G)$ and $\sigma(B)$, respectively, the optical density of the three types of fluorescence centers is proportional to $1/\sigma(R)$, $1/\sigma(G)$ and $1/\sigma(B)$, respectively.

24. The lighting unit as claimed in claim 23, wherein the transparent member is tubular, and has a phosphor concentration distribution in the lengthwise direction of the tube, and the optical density of the fluorescence centers therein increases within the range of 10 % of the overall length of

the tube from the end of the tube.

25. A lighting unit comprising:

a UV emitter emitting UV rays;

a visible light emitter receiving the UV rays and emitting visible light;

a UV/visible light reflector reflecting the UV rays and the visible light; and

an open end through which the visible ray is emitted;

wherein the visible light emitter is provided on the reflective surface of the UV/visible light reflector.

26. The lighting unit as claimed in claim 25, wherein the UV reflector that reflects UV rays is provided at the open end.

27. A lighting unit comprising:

a UV emitter emitting UV rays;

a visible light emitter receiving the UV rays and emitting visible light;

a UV/visible light reflector reflecting the UV rays and the visible light; and

an open end through which the visible ray is emitted;

wherein the visible light emitter is provided at the open end.

28. The lighting unit as claimed in claim 25, further comprising a second visible light emitter provided in the region that faces the open end of the UV emitter for receiving the UV rays emitted by the UV emitter and emitting visible light.

29. The lighting unit as claimed in claim 28, wherein the second visible light emitter is provided within the region of a perspective angle at which the open end is targeted from the center point of the UV emitter.

30. The lighting unit as claimed in claim 25, wherein the visible light emitter is composed of a plurality of emitters that differ in the wavelength range of the light to be emitted by each of them.

31. The lighting unit as claimed in claim 25, wherein the UV reflector is characterized in that a reflectance is the highest for the light falling within a wavelength range of from 150 to 300 nm and that a transmittance is the highest for the light falling within a wavelength range of from 400 to 650 nm.

32. A liquid crystal display with a liquid crystal sandwiched between a pair of facing two substrates, which comprises:

the lighting unit of any one of claims 1, 3, 4, 9, 13, 15-20, 25 or 27.

33. A lighting unit comprising:

a plurality of optical waveguides disposed adjacent to a display panel surface to be illuminated; and

an emission tube disposed between the optical waveguides and nearer to the back surfaces of the optical waveguides than to the light-emitting surfaces thereof that face the display panel surface.

34. The lighting unit as claimed in claim 33, further comprising a reflector disposed adjacent to the emission tubes on the side thereof opposite to the display panel surface.

35. The lighting unit as claimed in claim 33, further comprising a light-scattering element disposed between the neighboring optical waveguides in the space between the display panel surface and the emission tubes.

36. The lighting unit as claimed in claim 35, wherein the light-scattering element is an anisotropic light-scattering element of which the light-diffusing ability varies depending on the direction of an entering light.

37. The lighting unit as claimed in claim 33, further comprising a reflector is disposed between the neighboring optical waveguides in the space between the display panel surface and the emission tubes.

38. The lighting unit as claimed in claim 33, wherein the light-entering surface of each optical waveguide at an end meets the back surface thereof at an obtuse angle.

39. The lighting unit as claimed in claim 38, wherein each optical waveguide is made of a transparent member having a refractive index, $n = 1.41$ or more; and

the obtuse angle is larger than 90° but not larger than 102°.

40. The lighting unit as claimed in claim 33, further comprising a diffuser disposed on the surface of each optical waveguide.

41. The lighting unit as claimed in claim 40, wherein the diffuser is a diffusion pattern of a plurality of diffusion dots disposed on the back surface of each optical waveguide.

42. The lighting unit as claimed in claim 40, wherein the diffuser is a plurality of recesses each having a triangular cross section, formed on the back surface of each optical waveguide.

43. The lighting unit as claimed in claim 40, further comprising a second optical waveguide having thereon adhesive spots capable of optically bonding to the surfaces of the plurality of optical waveguides.

44. The lighting unit as claimed in claim 43, wherein the diffuser is attached to the second optical waveguides and not to the plurality of optical waveguides.

45. A lighting unit comprising:

a transparent parallel-plate substrate; and

an inclined part formed around the light-entering surface of the substrate at the end thereof via which the light from the light source enters the substrate, wherein the inclined part has an inclined surface that ascends from the side surface of the substrate toward the light-entering surface thereof, and the angle of inclination, α, of the inclined part is so

defined that the light having entered in the substrate via a light-entering surface undergoes total reflection on the inclined surface and thereafter further undergoes total reflection in the area of the substrate.

46. The lighting unit as claimed in claim 45, wherein the angle of inclination, α, satisfies the following formula:

$$n \cdot \sin(\theta - 2\alpha) \geq 1$$

in which θ indicates the maximum incident angle of the light that enters the substrate via the inclined surface when the angle of inclination, $\alpha = 0$ or $\theta = \pi/2 - \sin^{-1}(1/n)$; and

n indicates the refractive index of the inclined part.

47. The lighting unit as claimed in claim 45, wherein the length of the inclined surface (length of inclination, l) in the cross section cut along the plane perpendicular to both the inclined surface and the surface of the substrate is so defined that the incident light having passed through the light-entering surface does not hit the inclined surface predetermined times or more.

48. The lighting unit as claimed in claim 45, wherein the inclined part is disposed on either one of the light-emitting surface of the substrate or the back surface thereof opposite to the light-emitting surface, around the light-entering surface of the substrate; and

the light-entering surface is so worked that the surface meets the inclined part-standing surface of the substrate at an obtuse angle.

49. A liquid crystal display comprising a liquid crystal panel with liquid crystal sealed between facing two substrates, and a lighting unit disposed adjacent to the surface of the liquid crystal panel to be illuminated by the unit, wherein the lighting unit is claim 33 or 45.

50. A light source comprising:

a hollowed transparent member;

a discharge gas layer sealed in the hollow; and

a phosphor layer of which a surface facing the discharge gas layer is planarized.

51. A light source comprising:

a hollowed transparent member;

a discharge gas layer sealed in the hollow; and

a phosphor layer comprising phosphor particles and a binder, of which the surface opposite to the discharge gas layer is roughened nearly in accordance with the configuration of the phosphor particles therein.

52. A light source comprising:

a hollowed transparent member;

a discharge gas layer sealed in the hollow; and

a phosphor layer comprising phosphor particles and a binder, of which the surface facing the discharge gas layer is planarized and the surface opposite to the discharge gas layer is roughened nearly in accordance with the configuration of the phosphor particles therein.

53. The light source as claimed in claim 50, wherein

the phosphor layer is formed around the outer wall of the transparent member.

54. The light source as claimed in claim 50, wherein the phosphor layer is spaced from the transparent member.